3. What bit error rates does your proposed distribution format require of the transport system? Your production contribution format?

10^{-4} is satisfactory for both.

Consumer

1. What is required in a consumer VCR for the system? When will such a VCR be available? Is new technology required first? What format is to be recorded? Are any current VCR features not possible with this format? Have you verified this experimentally?

See response of 3/6/92.

Satellite

1. Is it possible to carry the ATV signal and an NTSC signal on the same transponder? If so, at what bandwidth? What other multiples are possible with your system?

See 3/6/92 response.

2. See questions 3 & 6 under Broadcast above.

See answers to corresponding broadcast sections above.

IS/WP2-0212
24 JUN 92

GENERAL INSTRUMENT

VideoCipher Division
General Instrument Corporation
6262 Lusk Boulevard
San Diego, CA 92121
619/455-1500
FAX 619/535-2486

May 19, 1992

Merrill Weiss
Acting Chairman, IS/WP-2
25 Mulberry Lane
Edison, NJ 08820-2908

Dear Merrill:

Attached please find General Instrument's response to the IS/WP-2 follow-up questions, dated March 17.

Sincerely,

Bob Rast

Robert M. Rast
Vice President, HDTV Business Development

cc: Jerry Heller
Jeff Krauss
Jae Lim
Woo Paik
Quincy Rodgers

Answers to IS/WP-2 Follow-Up Questions

General Instrument DigiCipher HDTV

May 19, 1992

General

1. Existing DigiCipher protocols and data structures are proprietary. We are open to the idea of conforming to an existing industry standard, but would need specifics to be definite. We will be further defining the protocol, and would be pleased to work with the Advisory Committee or an appropriate industry group in doing so. The DigiCipher protocol has been designed to be flexible, and therefore will be able to accommodate data from other services.

2. From 0 to 3 months for both standards setting and for design and manufacture.

3. During the rest of this year we will be exchanging information with a limited number of manufacturers. By the end of the year we will have developed a package.

4. We expect to initiate serious IC development by mid-year 1992, and therefore expect to have first IC's available by mid-year 1994.

5. We estimate that the FCC Report and Order will be issued by year end 1993. Consistent with our estimate of IC availability by mid-1994, we estimate first receivers available commercially by year end 1994.

   A risk against those estimates is the degree to which the selected system may be modified during the FCC comment period preceding the Report and Order. We will separately comment on the IS/WP-2 PERT and Gantt charts.

Broadcast

1. We have refined our coverage analysis, with a result that our projected power levels (ERP) are now lower than we cited in the answers we supplied on February 24. We now estimate:

	32-QAM	16-QAM
UHF	23.9 dBK	19.9 dBK
Low band VHF	1.6	-2.1
High band VHF	6.9	2.9

2. We are aware of substantial interest in and discussion of professional level, or lossless, ("pro compression") for high quality production and post production use. Such compression

is viewed to be intraframe only, and in the 100-200 Mbps range.

We assume pro compression will be available and utilized eventually, although perhaps not in the early days of the HDTV broadcast service. We foresee no compatibility problems between pro compression and DigiCipher compression.

3. We expect that during the early years the signal distributed by broadcast and cable networks will be the transmission signal. During that period we expect the emphasis to be on pass through, with minimal local editing.

   Over time we anticipate increased emphasis on local editing. We expect networks to migrate to a higher level DigiCipher feed ("distribution level"). While not lossless, this signal will be more transparent to editing. This distribution level signal will utilize DigiCipher compression with a video data rate in the 30-40 Mbps range.

   We have simulated DigiCipher compression at 30 Mbps video data rates, with very pleasing results. We expect to conduct hardware tests in the near future. We also expect to experiment with the algorithm at even higher data rates.

   The DigiCipher algorithm incorporates interframe coding, and adaptively processes in field and frame modes.

4. Our previous answer assumed editing of the transmission level signal, the most demanding case.

   Cuts would most effectively occur on frame boundaries. A cut-in should start with a PCM frame, which occurs on scene change. Cuts are most easily accomplished when both signals are at black level.

6. We believe that FDM is more appropriate. 32-QAM is more spectrum efficient than QPSK, though either could be used.

7. See B.3, above.

Cable

1. Scrambling can be done by bit-by-bit exclusive OR'ing with a pseudo-random data stream. The scrambling is not complex to do, and can be done either at a source or downstream. Channel synchronization and data stripping can be done while maintaining the picture in scrambled mode.

Common Carrier

3. One uncorrectable error in 10 minutes corresponds to a raw error rate of 1.7x10E-2, and one uncorrectable error in one hour corresponds to a raw error rate of 1.4x10E-2.

Consumer

1. To clarify, we assume the question did not mean to imply that features should be available during recording, but rather only during playback. We have demonstrated, with Toshiba, a prototype DigiCipher HDTV VCR, recording a fully-compressed DigiCipher signal at 18.2 Mbps. We have also studied implementation of playback features, and are comfortable that a full set can be implemented.

   Speed search functions will utilize PCM (intraframe) refresh data, which is used to continuously refresh one-eleventh of the picture each frame, and thus the whole picture every 11 frames. There are no restrictions on speeds caused by the technique.

IS/WP2-0213
24 JUN 92

DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTS 02139

June 11, 1992

Mr. S. Merrill Weiss
Vice Chairman, IS/WP-2
25 Mulberry Lane
Edison, New Jersey 08820-2908

Dear Merrill:

I am enclosing MIT's response to your committee's follow-up questions.

I am working on the two tables. I will send you MIT's response as soon as possible.

Thank you.

Sincerely,

Jae S. Lim
Director of Advanced Television
Research Program

IS/WP-2 Follow-up Questions Regarding

Channel-Compatible DigiCipher System

General

1. Extensibility is provided by source-adaptive processing and the concept of headers.

   A video signal consists of a sequence of frames. Each frame has a header which contains information that is required or useful about the frame. The frame header includes such information as frame rate, spatial dimensions of the frame in pixels, aspect ratio, color space, and the processing method used. The video signal format used initially by broadcasters may be 1280 × 720 active pixels/frame at 59.94 fps, but extension to other signal formats is accommodated. The receiver will decode the relevant information from the frame header, and processing will automatically be adapted to the decoded frame header information.

   Even though the current header protocols and data structures are proprietary, the flexible data structure allows us to adapt to a reasonable industry standard.

   The idea of source adaptive processing originated from the need to accommodate many possible source formats. In a traditional approach, these different source formats are converted to one format. In source adapative processing, source formats are preserved and encoding and decoding are adapted to the source formats. The format conversion, if needed, takes place at the receiver. This form of processing is much more efficient in utilizing the available bits than the traditional approach.

   The specific source format information contained in the frame header drives the encoding and decoding process. It is possible to use very different encoding strategies. In the CCDC HDTV system, however, we have chosen to use the same encoding method and to change only the effective coding rate for the specific source format.

   Extension to various different source formats is automatic. Extension to services which are not envisioned at the time of standardization can be accommodated using the unused portion in the frame header. The receiver that can recognize the services will be able to decode it and use the new service. A receiver that does not recognize the new service will simply ignore it.

   The CCDC receiver will have to be programmed to read the frame header information, and to decode the received data according to the decoded frame header information. This is straightforward. The receiver will also have to be programmed to convert the decoded data to a form that can be displayed on the particular receiver.

2. Technical information sufficient to begin the writing of both FCC rules and technical standards will be available in a maximum of 4 months. The information supplied in this

period will be sufficient to permit the start of IC and product design by manufacturers unrelated to our development program.

The personnel resources applied to the development of the necessary documentation will be derived from MIT's Advanced Television and Signal Processing Group and GI's VideoCipher division. Jae Lim from MIT's ATSP group was in charge of preparing a technical standard for an international voice codec standard.

3. We have not yet developed a specific plan for technology transfer. We are working with General Instrument to develop such a plan. The plan will involve technology transfer to IC and product manufacturers.

4. We expect that IC's will be available within 18 months from the trigger point.

5. Our interpretation of the concept of system introduction is commercial availability of transmitters and receivers. We expect that this will happen within 18 months from the FCC's decision.

Broadcast

2. Signal formats that we anticipate for studio production initially are (720/59.94/1:1), (720/30/1:1), and (720/24/1:1), where 720 represents the number of active lines. Later on, we anticipate other formats such as (1080/30/1:1). Our proposal can accept essentially any signal format through source adaptivity. What is needed is insertion of a frame header that specifies the signal format used at the transmitter. At the receiver, we need the capability to read the frame header information, to decode the received data according to the frame header information, and to display the decoded video consistent with the receiver display.

   If the 180 Mb/s compressed form were used in the studio, it would have to be decompressed prior to cutting, keying, and full image manipulation. We have determined that the 180 Mb/s rate is adequate for studio use based on computer simulation using a limited set of data. We need to verify this number using a much more extensive set of data.

3. In the initial years, broadcast and cable networks are likely to distribute transmission signals with emphasis on pass-through, with minimal local editing. In later years, distribution signals whose bit rates are between transmission signals and production signals are anticipated to be used. We expect that the bit rate for distribution signals is in the range of 30-50 Mb/s. The compression anticipated will use inter-frame processing.

4. There is a possibility of partial decompression for further production. This would involve a fair amount of processing. It would be easier to decompress the signal fully.

5. We have not performed extensive simulations of multi-generation compression and decompression. Based on limited simulations, multi-generation compression and decompression should be avoided for transmission signals, but are possible for production signals.

6. Digital HDTV signals are compressed to 6Mhz and digital NTSC signals are compressed to 3Mhz. FDM multiplexing of the two would be more appropriate. The modulation would be on the microwave channel 32 QAM.

7. See Answer in B.3.

8. We do not yet have information on the percentage of time peak powers of various levels above the average power occur with our system. We will be able to provide this information when the real time system is fully integrated.

9. We can provide this information when the real time system is fully integrated.

10. The CCDC HDTV system has been designed to be capable of dealing with multiple signals carrying identical modulation at the receiver. The adaptive equalizer in the prototype CCDC system can operate up to approximately 5 Hz. The CCDC system requires 6dB differences for up to 4 μsec. in offset in time, and 12dB for up to 24 μsec.

Cable

1. The scrambling operation is straightforward. It can be done at the source or downstream. Channel synchronization and data stripping can be accomplished with a scrambled picture.

Common Carrier

1. By "baseband", we mean the signal that feeds the modulator. The bit rate of the signal is 26.43 Mb/s for 32 QAM.

3. The bit error rate of 10^{-9} refers to the error rate at the ouput of the Reed-Solomon decoder. If the system carried the same amount of data without error correction, the bit error rate would have been approximately 10^{-2}.

Consumer

1. Our signal may be directly recorded in digital format. Rewind search operations will utilize the intra-frame encoding mode. One twentieth of each frame is refreshed continuously, thereby encoding three frames/sec using the intra-frame mode. These frames can be used for rewind search mode.

Satellite

1. Transponder bandwidths are typically between 36 and 72 MHz. Frequency division multiplexing (FDM) can be used to carry both ATV and NTSC signals. Time division multiplexing (TDM) can also be used to carry ATV and digital NTSC signals. The CCDC HDTV signal would require 12 MHz bandwith using QPSK modulation (8PSK trellis coded). A single transponder can easily carry several CCDC-HDTV signals.

IS/WP2-0214
24 JUN 92

FCC Advisory Committee on Advanced Television Service
Implementation Subcommittee Working Party 2 on Transition Scenarios (IS/WP-2)

Draft Final Report Executive Summary

IS/WP-2 was constituted to develop transition scenarios for the conversion to Advanced Television. In doing so, it sought to develop scenarios for each of the industry segments involved in the transition, to identify any potential differences in the implementations of the proposed systems, and to identify potential problems in the implementation of ATV.

Information was obtained through direct communications and surveys from proponents, professional and consumer equipment manufacturers, broadcasters, and experts in relevant industry sectors. The Working Party developed a series of PERT and Gantt charts and lists of underlying assumptions to serve as a reference for those tasked with implementing the ATV service.

The Working Party found that, in general, the time required to implement ATV is approximately the same for all industry sectors and for all proposed systems. The Working Party identified tasks on the critical path to implementation, first and foremost among which is the disclosure of and agreement on full technical details of the selected system sufficient to permit design and manufacture of integrated circuits and equipment for encoding, transmitting, receiving, and decoding ATV signals by parties other than the proponent.

IS/WP-2 identified the need for new towers in some locations, principally high population centers, as critical to the delivery of ATV to the largest proportion of the population of the United States. IS/WP-2 surveys indicate that, depending upon the exact power requirements of systems, between one-third and one-half of television stations will require new towers. On the other hand, IS/WP-2 found that, in the abstract, stations can implement ATV within the 5-year window established by the FCC. IS/WP-2 also found, however, that provision must be made in FCC procedures for those stations that, no matter how hard they try, will be precluded from implementing within the 5-year window by factors beyond their control. Economics were not considered in any of these conclusions.

Expert input and a survey of all consumer manufacturers indicate that ATV receivers will be generally available in the marketplace 2½—3 years following the unambiguous selection of a system. A small quantity of receivers may be available sooner. This presumes timely adoption of technical standards to support manufacture.

A distributed (multiple transmitting sites sharing the same frequency) approach to transmission has been suggested, whcih may optimize coverage and use of spectrum. This technique may be particularly important to stations whose implementation of ATV may be impeded by peak power requirements which are higher than originally expected (and consequent problems of tower loading, etc.).

IS/WP2-0215
24 JUN 92

FOX INC

P.O. Box 900
Beverly Hills, California 90213
Phone 310 203 1334 • Fax 310 203 4069

Twentieth Century Fox
Twentieth Television
Fox Television Stations Inc.
Fox Broadcasting Company

George Vradenburg III
Executive Vice President

Via facsimile (914) 945-6322

Dr. J. Peter Bingham
Chairman, IS/WP2
President
Philips Laboratories
345 Scarborough Road
Briarcliff Manor, NY 10510

Dear Peter:

Mr. Wiley has asked that all ACATS subcommittees and working parties review with his office all surveys and questionnaires directed to HDTV proponents, to industry segments or to others outside the ACATS structures. Please advise me promptly of any intended use of such materials.

Sincerely,

George Vradenburg III

GV:co

IS/WP2-0216
24 JUN 92

FCC Advisory Committee on Advanced Television Service
Implementation Subcommittee Working Party 2 on Transition Scenarios (IS/WP-2)
Systems Subcommittee Working Party 3 on Economic Analysis (SS/WP-3)

To: ATV System Proponent Representatives

From: Merrill Weiss (MW)

Date: May 26, 1992

Re: Further Updated Block Diagrams & Tables

As agreed at last week's SS/WP-3 meeting, the ATV Television Station block diagrams and accompanying tables have been updated slightly to make them clearer as to what is expected. Copies of the further updated block diagrams of a "minimal" ATV television station and of a "transitional" ATV television station and their related tables follow.

The changes to the block diagrams are the addition of a box for customer premises equipment on the common carrier fiber input, the addition of a note explaining that the boxes marked as "optional" are optional in a station's design but are required as part of the analysis by the Working Parties, the indication that the input to the NTSC upconverters are composite analog NTSC, and the change of box 5 (previously box 4) of the "transitional" block diagram from strictly commercial playback to a more general record/playback function. The blocks have been renumbered to accommodate the inclusion of the customer premises equipment.

The changes in the tables are all in the equipment functional descriptions for the respective block diagrams. In the case of the "transitional" station, the description of the VCR at unit #5 is changed to reflect the change in the block diagram as outlined in the preceding paragraph. The description of unit #11, the ATV Master Control is modified with the addition of the requirement for separate audio and video switching and mixing capability. In the equipment functional description for both stations, the description of the satellite receiver and demodulator, unit #1, has the added explanation that it is expected to provide any error correction needed to correct for satellite channel deficiencies.

These changes should not affect any descriptions you have written previously in responding to the block diagrams except to the extent your understanding of the particular functions modified in this update improves. There will be a need to renumber the descriptions to make them track with the new numbering in the block diagram as explained above. The instructions as to what is expected of you in response remain exactly the same as in my memo to you of April 30. The entirety of

the package is being forwarded to you again, including another copy of the April 30 memo, to save you from having to re-collate or refer to two documents.

Let me remind you that this material is needed by **both** IS/WP-2 and SS/WP-3. It is important to the work of both Working Parties that you return the filled-in tables as soon as possible. If you have already submitted a response based upon the earlier distribution of this material, please supply an update. In order to permit study of the material by the participants in the Working Parties (and processing by IS/WP-2) prior to the next meetings of the Working Parties, please return your responses to both Larry Thorpe and me no later than Friday, June 5. The next meeting of SS/WP-3 is Tuesday, June 23, with IS/WP-2 meeting the following day.

If you have any questions regarding the needs of the Working Parties in relation to your responses, please call either Larry Thorpe or myself. If there are questions regarding the operation of any items in the block diagrams, the following group of individuals has volunteered to act as a consulting task force for you. They will explain the operation of any of the boxes in more detail than can be included in the functional description table, should that be of help to you. Feel free to call any one of them.

David Chilson
ABC-TV
47 W. 66th Street
New York, NY 10023
(212) 456-3662

Bob Ross
KYW-TV/Group W
Independence Mall East
Philadelphia, PA 19106
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David Folsom
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Providence Journal
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Charlotte, NC
28217-1901
(704) 329-3632
FAX (704) 357-4980

Merrill Weiss
25 Mulberry Lane
Edison, NJ 08820-2908
(908) 906-0907
Phone & FAX

This material will be sent to you both by FAX and by Priority Mail today. The FAX copy is to get you started. Please use the cleaner, mailed copy for your reponses. As before, if you need copies of the tables with more space in the blocks, please let me know; they will be easy to supply.

FCC Advisory Committee on Advanced Television Service
Implementation Subcommittee Working Party 2 on Transition Scenarios (IS/WP-2)
Systems Subcommittee Working Party 3 on Economic Analysis (SS/WP-3)

To: ATV System Proponent Representatives

From: Merrill Weiss

Date: April 30, 1992

Re: Updated Block Diagrams & Accompanying Tables

As agreed at the IS/WP-2 & SS/WP-3 meetings last week, the ATV Television Station block diagram has been updated and split into two related block diagrams. The accompanying tables have similarly been split into two sets, each connected with one of the block diagrams. The tables have also been supplemented with an additional table providing you with functional descriptions of the items in each of the block diagrams. Copies of the updated block diagrams and their related tables follow.

The two block diagrams now represent a "minimal" ATV television station and a "transitional" ATV television station. The "minimal" station is intended to represent the minimum a station could do and still meet the requirements of its license. It assumes that a substantial amount of programming comes by way of upconversion from NTSC. Similarly, commercials, ID's, emergency announcements, and the like are upconverted NTSC. The entire facility is assumed to operate on fully compressed ATV signals. A record/play VTR or VCR is shown as an option for stations such as independents or public stations that must accept programming on tape or do their own time shifting. The machine is assumed to have no "trick" modes (even to the extent of not including picture in shuttle, if necessary). Master Control continuity switching must provide clean cuts but no effects such as dissolves, wipes, or keys.

The "transitional" station represents a more sophisticated (and potentially more expensive) approach in which an infrastructure is built to allow the later inclusion of more complete production and processing of the signals. Again, a substantial amount of programming is assumed to initially be upconverted NTSC. But commercials are assumed to begin coming to the station in ATV form fairly quickly to accompany programs delivered in ATV form, and a VTR or VCR is provided in Phase 2 for them. ID's, emergency announcements, and such are generated in ATV form for higher quality than upconversion yields. Although not shown because they arrive in Phase 3, record/play VTR's or VCR's are certainly anticipated for inclusion in the system at a relatively early time. Master Control continuity switching must provide clean cuts initially, and the infrastructure chosen must support use of effects later on.

There are now two sets of tables for you to fill in — one for each block diagram. Since the "minimal" system has fewer elements than the "transitional" system, the letters and numbers representing the missing lines and blocks have been deleted from its tables. The corresponding letters and numbers in the two diagrams and tables represent similar functions, although often located at different points in the two systems. The internal functionalities of the various items of equipment and their interfaces are expected to be quite different between the two sets, however, because of the different underlying assumptions made for the two approaches.

Now part of each set of tables is one already filled in, giving you a functional description of each equipment element in each system. These have been provided to help those not familiar with broadcast station practice to understand what is required of the systems. The descriptions provided define the generic functionality. When you fill in the "Requirements for Equipment and Descriptions" tables, you are expected to provide a much more detailed description of the internal functionality required of each device based upon its use with your particular system.

The next meeting of IS/WP-2 is Tuesday, May 19, with SS/WP-3 meeting the following day. Consequently, the following tables must be returned filled in by Thursday, May 14, to permit advance distribution to participants in the two Working Parties. Please send copies of your responses both to Larry Thorpe and to me. If you have any questions regarding the needs of the Working Parties in relation to your responses, please call either or us. If there are questions regarding the operation of any items in the block diagrams, again please call either of us.

This material will be sent to you both by FAX and by Priority Mail today. The FAX copy is to get you started. Please use the cleaner, mailed copy for your reponses. As before, if you need copies of the tables with more space in the blocks, please let me know; they will be easy to supply.

FCC Advisory Committee on Advanced Television Service
Implementation Subcommittee Working Party 2 on Transition Scenarios (IS/WP-2)
Systems Subcommittee Working Party 3 on Economic Analysis (SS/WP-3)

ATV "Minimal" & "Transitional" Television Station Block Diagrams and Tables

Key to Signal Format Categories and Related Data

Organization of Data in this Key:

Cat. # Category Description
- A. Data for Column A
- B. Data for Column B
- C. Data for Column C

Categories and Related Data:

1. Component Video (Uncompressed/3 components)
   - A. Analog, Digital
   - B. Raster Format (#lines/F_V/Interlace ratio)
   - C. Component Set (GBR, YP_BP_R)

2. Intra-Plant Compression
   - A. Bit Rate (serial digital assumed)
   - B. Intra-field, Inter-field
   - C. Sub-sampling (H & V, by component)

3. Inter-Plant Distribution/Contribution Compression
   - A. Bit Rate
   - B. Intra-field, Inter-field
   - C. Sub-sampling (H & V, by component)

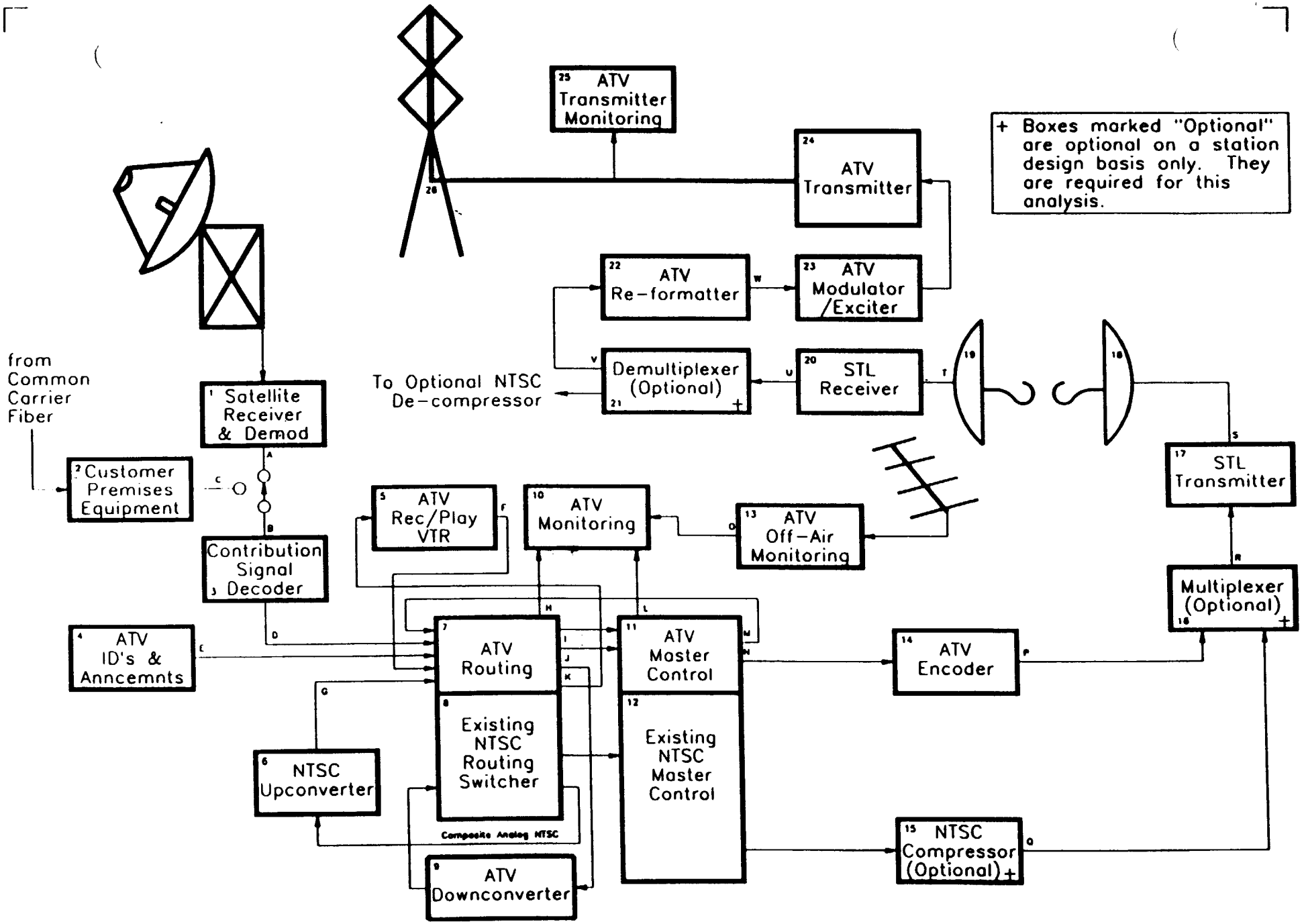
4. ATV Final Compression
   - A. Bit Rate

5. ATV Signal Processed for Terrestrial Broadcast Transmission
   - A. Analog, Digital
   - B. Bandwidth or Bit Rate (as appropriate)

6. ATV Signal Processed for Studio-to-Transmitter Link (STL) Transmission
   - A. Analog, Digital
   - B. Bandwidth or Bit Rate (as appropriate)

7. Modulated STL Signal
   - A. Modulation Technique
   - B. Bandwidth

8. Modulated Terrestrial Broadcast Signal
   - A. System Name



ATV "Transitional" Television Station

ATV "Transitional" Television Station Signal Format Categories and Related Data				
Signal	**Cat.#**	**Data A**	**Data B**	**Data C**
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				
S				
T				
U				
V				
W				

See associated "Key to Signal Format Categories and Related Data" for the information required in each column

ATV "Transitional" Television Station Requirement for Equipment and Descriptions		
Unit #	**Req.[1]**	**Description**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
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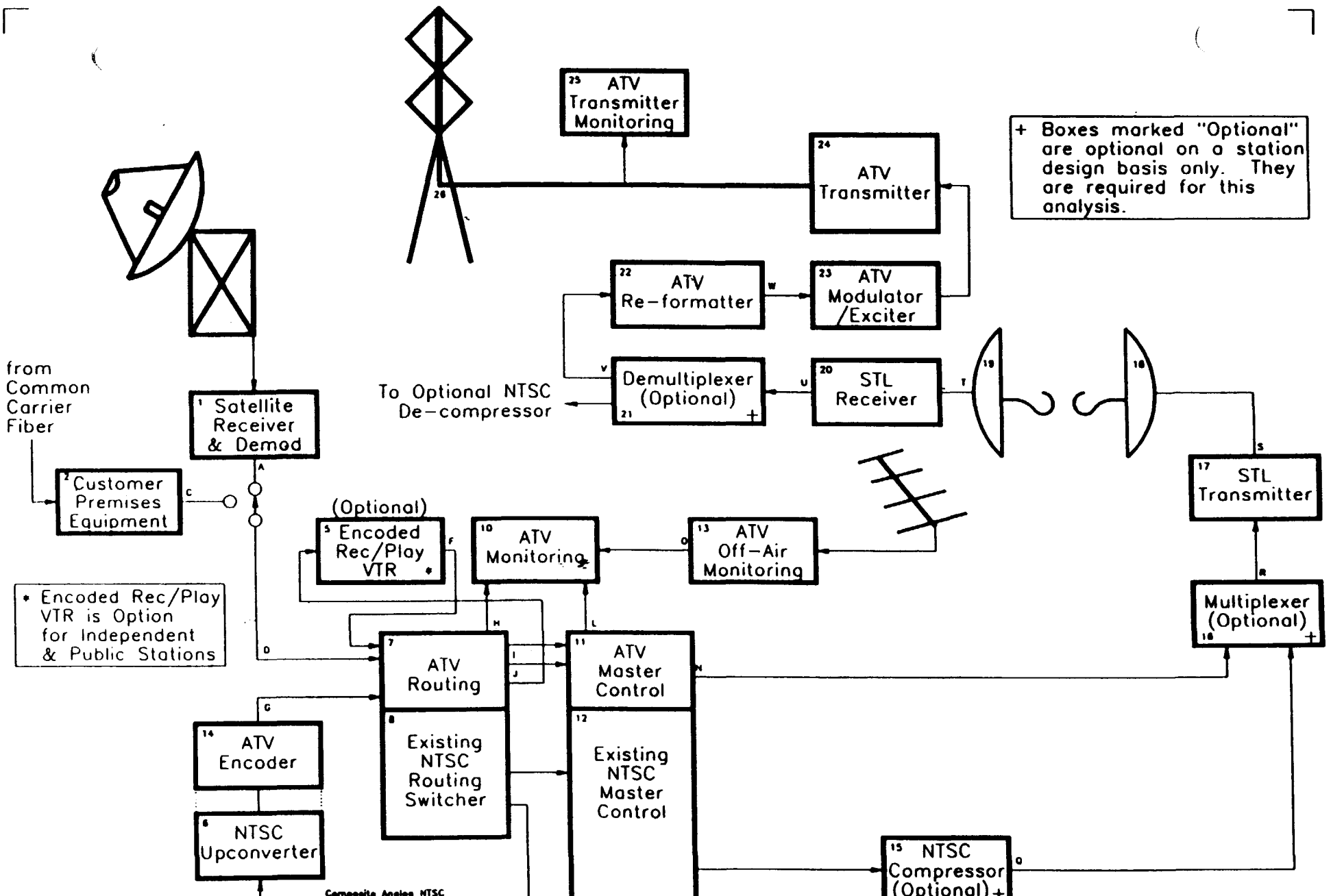
25		
26		

[1] Requirement for each Unit indicated by: X = Required, O = Optional, N = Not Needed

ATV "Transitional" Television Station Equipment Functional Descriptions	
NOTE: Assumes facilities to permit growth from minimal ATV implementation to normal television station operations. May involve use of interfaces with other than fully compressed ATV signals.	
Unit #	**Description**
1	Satellite Receiver & Demodulator - Delivers ATV partially or fully compressed signal from satellite for further processing and transmission. If signal is partially compressed, further source coding is assumed to be required. Provides any error correction required to compensate the satellite link.
2	Customer Premises Equipment for Common Carrier connection removes any bits added (stuffed) at the transmission point to match the common carrier data rate. Delivers fully ATV compressed signal ready for transmission without further source coding.
3	Contribution Signal Decoder - Decodes incoming satellite or fiber delivered signals into form used throughout station for further processing.
4	ATV ID's & Announcements - Provides signals for doing Station Identification and making emergency announcements. May be some form of character generator. Output is in signal form used throughout station (possibly compressed).
5	ATV Record/Play VTR - VTR's or VCR's that record and play back tapes in signal form used throughout station. Signal form on the tape itself may or may not be the same as form used for station distribution/processing. Used for time shifting, commercial record and playback. No "trick" modes needed, but picture in shuttle (non-broadcastable) required.
6	NTSC Upconverter - Decodes NTSC input signals to components & converts raster structure to that matching signal form used throughout station. Encoding/compression may be also be required to match signal form used elsewhere.
7	ATV Routing - Permits distribution & switching of signals around facility. Delivers multiple signals to ATV Master Control for clean on-air switching. May be as simple as a patch panel. Eventually likely to be an electronic switch.

8	Existing NTSC Routing Switcher - Used to distribute & switch signals in the existing NTSC plant. Signals carried may range from analog encoded NTSC to serial digital components, depending upon station technical sophistication.
9	ATV Downconverter - Decodes ATV input signals, converts raster structure to 525 lines/2:1, encodes NTSC.
10	ATV Monitoring - Provides picture monitoring for signals distributed internally, for Master Control output, and for off-the-air signals.
11	ATV Master Control - Provides continuity switching of on-air signals. May include effects (wipes, dissolves, keys, etc.). Audio and video must be separately switchable and mixable. Control may be linked to NTSC Master Control switcher.
12	Existing NTSC Master Control - Provides on-air continuity switching of NTSC signals for existing station. Uses analog encoded NTSC in the near term. May provide automated control for ATV Master Control switcher.
13	ATV Off-Air Monitoring - Provides off-air reception & demodulation of ATV signals for remote control purposes. Includes special test equipment necessary to maintain & certify proper transmitter operation. Picture monitoring handled by ATV Monitoring block.
14	ATV Encoder - Encodes ATV Master Control output for transmission. Input may be uncompressed or partially compressed signals, depending upon choice made for station internal operation. Output is in form suitable for STL transmission, which may be different from actual broadcast signal format.
15	NTSC Compressor - Optional device to permit combination of NTSC signal with ATV signal for transmission over single Studio-to-Transmitter Link (STL).
16	Multiplexer - Optional unit to combine compressed ATV and compressed NTSC signals into single signal for STL transmission.
17	STL Transmitter - Microwave transmitter for either compressed ATV signal alone or combined compressed ATV & NTSC signals.
18	Transmit Dish Antenna for Microwave STL
19	Receive Dish Antenna for Microwave STL
20	STL Receiver - Microwave receiver for either compressed ATV signal alone or combined compressed ATV & NTSC signals.
21	Demultiplexer - Optional unit to separate multiplexed compressed ATV and NTSC signals into individual signals after STL transmission.

22	ATV Re-formatter - Converts compressed ATV signal from form used for STL transmission to form needed to modulate ATV broadcast transmitter.
23	ATV Modulator/Exciter - Generates modulated ATV signal and converts to broadcast channel frequency for input to transmitter.
24	ATV Transmitter - High power amplifier for on-channel signals from exciter.
25	ATV Transmitter Monitoring - Combines necessary RF conversion, demodulation, decoding, picture monitoring, and special test equipment for certification & maintenance of proper transmitter operation.
26	ATV Broadcast Antenna



ATV "Minimal" Television Station

ATV "Minimal" Television Station Signal Format Categories and Related Data				
Signal	**Cat.#**	**Data A**	**Data B**	**Data C**
A				
C				
D				
F				
G				
H				
I				
J				
L				
N				
O				
Q				
R				
S				
T				
U				
V				
W				

See associated "Key to Signal Format Categories and Related Data" for the information required in each column